Nortel Metro Ethernet Routing Switch 8600

Installation — SFP, XFP, and GBIC Hardware Components

NN46220-301 (324012-A Rev 04)

Document status: Standard
Document version: 02.04
Document date: 14 February 2008

Copyright © 2008, Nortel Networks
All Rights Reserved.

Sourced in Canada and the United States of America

LEGAL NOTICE
While the information in this document is believed to be accurate and reliable, except as otherwise expressly agreed to in writing NORTEL PROVIDES THIS DOCUMENT "AS IS" WITHOUT WARRANTY OR CONDITION OF ANY KIND, EITHER EXPRESS OR IMPLIED. The information and/or products described in this document are subject to change without notice.

Contents

New in this release 7
Features 7
1000BASE-EX SFP and 10GBASE-ZR/ZW XFP 7
Digital Diagnostic Interfaces 7
Other changes 7
10GBASE-SR XFP 7
Cleaning procedures 7
10GBASE-ZR/ZW 8
1000BASE-LX specification updates 8
Install times 8
1000BASE-BX SFP specification updates 8
Document changes 8

Introduction 9
Acronyms 9

Safety and equipment care information 11
Handling, safety, and environmental guidelines 11
Electrostatic discharge prevention 11
Care of fiber optic equipment 12
Fiber optic cable care 12
Fiber optic connector care 13
Cleaning single connectors 14
Cleaning duplex connectors 15
Cleaning receptacles 17
Product safety warnings and information 18
ESD and installation caution messages 18
Laser safety warnings 18
Electromagnetic interference compliance 19

Small form factor pluggable transceivers 23
Selecting an SFP 23
Procedure job aid: SFPs and common applications 24
Procedure job aid: SFP models 24
Procedure job aid: SFP models with DDI support 25
Installing an SFP 27

Copyright © 2008, Nortel Networks

Procedure job aid: locking and extractor mechanisms 28
Removing an SFP 29

Gigabit interface converters 31
Selecting a GBIC 31
Procedure job aid: GBIC models 32
Installing a GBIC 32
Removing a GBIC 33

10 Gigabit small form factor pluggable transceivers 35
Selecting an XFP 35
Procedure job aid: XFP models 36
Installing an XFP 37
Removing an XFP 38

SFP specifications 41
SFP labels 42
General SFP specifications 42
1000BASE-T SFP specifications 43
1000BASE-SX (LC) SFP specifications 43
1000BASE-SX (MT-RJ) SFP specifications 44
1000BASE-LX SFP specifications 44
1000BASE-XD CWDM SFP specifications 45
1000BASE-ZX CWDM SFP specifications 46
1000BASE-SX DDI SFP specifications 46
1000BASE-LX DDI SFP specifications 47
1000BASE-XD DDI 1310 nm SFP specifications 48
1000BASE-XD DDI 1550 nm SFP specifications 48
1000BASE-ZX DDI SFP specifications 49
1000BASE-XD DDI CWDM SFP specifications 50
1000BASE-ZX DDI CWDM SFP specifications 50
1000BASE-BX DDI SFP specifications 51
1000BASE-EX DDI SFP specifications 52

GBIC specifications 55
GBIC labels 55
GBIC physical specifications 56
1000BASE-T GBIC specifications 56
1000BASE-SX GBIC specifications 57
1000BASE-LX GBIC specifications 58
1000BASE-XD GBIC specifications 60
1000BASE-ZX GBIC specifications 60
1000BASE-EX CWDM GBIC specifications 61

XFP specifications 65
XFP labels 65
General XFP specifications 66

Copyright © 2008, Nortel Networks

10GBASE-SR XFP specifications 66
10GBASE-LR/LW XFP specifications 68
10GBASE-ER/EW XFP specifications 69
10GBASE-ZR/ZW XFP specifications 70

Copyright © 2008, Nortel Networks

Copyright © 2008, Nortel Networks

New in this release

The following sections detail what's new in *Nortel Installation — SFP, XFP, and GBIC Hardware Components* for Metro Ethernet Routing Switch Release 4.2 and Ethernet Services Unit 1800 and 1850 Release 3.4:

- "Features" (page 7)
- "Other changes" (page 7)

Features

See the following sections for information about feature changes:

1000BASE-EX SFP and 10GBASE-ZR/ZW XFP

Release 4.2 provides support for two new devices. See "1000BASE-EX DDI SFP specifications" (page 52) and "10GBASE-ZR/ZW XFP specifications" (page 70).

Digital Diagnostic Interfaces

Release 4.2 provides support for Digital Diagnostic Monitoring (DDM). DDM enables you to monitor laser operating characteristics. For more information about Digital Diagnostic Interfaces (DDI) and DDM, see "Procedure job aid: SFP models with DDI support" (page 25).

Other changes

See the following section for information about changes that are not feature-related:

10GBASE-SR XFP

Reach information for the 10GBASE-SR XFP is updated. See "10GBASE-SR XFP specifications" (page 66).

Cleaning procedures

Information about cleaning connectors and ports is updated. See "Fiber optic connector care" (page 13).

Copyright © 2008, Nortel Networks

10GBASE-ZR/ZW

The 10GBASE-ZR/ZW specifications are updated. See "10GBASE-ZR/ZW XFP specifications" (page 70). The specifications for each XFP have been updated to include the link budget and MTBF (see "XFP specifications" (page 65)).

1000BASE-LX specification updates

The optical power specifications for the AA1419015-E5 1000BASE-LX SFP are changed to -9.5 to -3.0 dBm. See "1000BASE-LX SFP specifications" (page 44).

Install times

The time required to install SFP, XFP, and GBIC transceivers is added to the installation procedures.

1000BASE-BX SFP specification updates

The specifications for the 1000BASE-BX SFP are updated (see "1000BASE-BX DDI SFP specifications" (page 51)).

Document changes

This document is reformatted to comply with Nortel Customer Documentation Standards (NCDS) guidelines.

Copyright © 2008, Nortel Networks

Introduction

This document provides installation instructions and technical specifications for:

- Gigabit Interface Converters (GBICs)
- Small Form Factor Pluggable (SFP) transceivers
- 10 Gigabit Small Form Factor Pluggable (XFP) transceivers

For a list of supported GBICs, SFPs, and XFPs see your latest product-specific release notes. Information contained in the Release Notes takes precedence over any information contained in this document.

Navigation

- "Safety and regulatory information" (page 11)
- "Small form factor pluggable transceivers" (page 23)
- "Gigabit interface converters" (page 31)
- "10 Gigabit small form factor pluggable transceivers" (page 35)
- "SFP specifications" (page 41)
- "GBIC specifications" (page 55)
- "XFP specifications" (page 65)

Acronyms

The following table defines acronyms used in this document.

CDR	clock data recovery
CWDM	coarse wavelength-division multiplexing
DMD	differential mode delay
EMI	electromagnetic interference
ESD	electrostatic discharge
GBIC	Gigabit Interface Converters

Copyright © 2008, Nortel Networks

LC	latch connector
LED	light emitting diode
MAN	metropolitan area network
MMF	multimode fiber
OMA	Optical Modulation Amplitude
OMUX	Optical Multiplexer/Demultiplexer
RJ	registered jack
SC	snap-in connector
SFP	small form factor pluggable
SMF	single mode fiber
TPE	Twisted Pair Ethernet
UTP	unshielded twisted pair
WAN	wide area network
WDM	wavelength-division multiplexing
XFP	10 Gigabit Ethernet small form factor pluggable

Copyright © 2008, Nortel Networks

Safety and equipment care information

This section contains important safety and regulatory information. Read this section before you install Small Form Factor Pluggable (SFP) transceivers, 10 Gigabit SFP (XFP) transceivers, or GigaBit Interface Converters (GBIC).

Navigation

- "Handling, safety, and environmental guidelines" (page 11)
- "Care of fiber optic equipment" (page 12)
- "Product safety warnings and information" (page 18)
- "Electromagnetic interference compliance" (page 19)

Handling, safety, and environmental guidelines

Before you install a GBIC, SFP, or XFP, read the following handling, safety, and environmental guidelines:

- GBICs, SFPs, and XFPs are static sensitive. To learn how to prevent damage from electrostatic discharge (ESD), see "Electrostatic discharge prevention" (page 11).
- GBICs, SFPs, and XFPs use optical connectors whose performance can be reduced by dust contamination. When you store a GBIC, SFP, or XFP, or when you disconnect it from a fiber optic cable, always keep a dust cover over the GBIC, SFP, or XFP optical bore.
- Dispose of this product according to all national laws and regulations.

Electrostatic discharge prevention

To prevent equipment damage, observe the following electrostatic discharge (ESD) precautions when handling or installing the components.

- Ground yourself and the equipment to an earth or building ground. Use a grounded workbench mat (or foam that dissipates static charge) and a grounding wrist strap. The wrist strap should touch the skin and be grounded through a one megaohm resistor.
- Do not touch anyone who is not grounded.

Copyright © 2008, Nortel Networks

- Leave all components in their ESD-safe packaging until installation, and use only a static-shielding bag for all storage, transport, and handling.
- Clear the area of synthetic materials such as polyester, plastic, vinyl, or styrofoam because these materials carry static electricity that damages the equipment.

Care of fiber optic equipment

Fiber optic equipment must be kept clean and damage-free. Use the information in this section to properly maintain and care for fiber optic equipment.

Care of fiber optic equipment navigation

- "Fiber optic cable care" (page 12)
- "Fiber optic connector care" (page 13)
- "Cleaning single connectors" (page 14)
- "Cleaning duplex connectors" (page 15)
- "Cleaning receptacles" (page 17)

Fiber optic cable care

Although the glass fiber of fiber optic cable is protected with reinforcing material and plastic insulation, it is subject to damage. Use the following precautions to avoid damaging the glass fiber.

- Do not kink, knot, or vigorously flex the cable.
- Do not bend the cable to less than a 40 mm radius.
- Do not stand on fiber optic cable; keep the cable off the floor.
- Do not pull fiber optic cable any harder than you would a cable containing copper wire of comparable size.
- Do not allow a static load of more than a few pounds on any section of the cable.
- Place protective caps on fiber optic connectors that are not in use.
- Store unused fiber optic patch cables in a cabinet, on a cable rack, or flat on a shelf.

Frequent overstressing of fiber optic cable causes progressive degeneration that leads to failure.

If you suspect damage to a fiber optic cable, either due to mishandling or an abnormally high error rate observed in one direction, reverse the cable pairs. If the high error rate appears in the other direction, replace the cable.

Copyright © 2008, Nortel Networks

CAUTION
Risk of equipment damage
Do not crush fiber optic cable. If fiber optic cable is in the same tray or duct with large, heavy electrical cables, it can be damaged by the weight of the electrical cable.

Fiber optic connector care

Before connecting them to transmission equipment, test equipment, patch panels, or other connectors, ensure fiber optic connectors are clean. The performance of an optical fiber connector depends on how clean the connector and coupling are at the time of connection.

A damaged or dirty connector can damage a connector with which it is mated. A connector must be absolutely clean before it is inserted into a transmitter or receiver.

Never clean an optical connector that is carrying light. Optical power can cause ignition of the cleaning material when it contacts the end of the optical connector, destroying the connector. Typical cleaning materials, for example, tissues saturated with alcohol, combust almost instantaneously when exposed to optical power levels of +15 dBm or higher.

Visually inspect the connector to determine cleanliness and to determine if it needs replacing. Any connector that has a scratch across the core, or a scratch that appears to end in the core, must be replaced.

The proper connector cleaning method depends on the connector contaminants:

- Cleanliness is best judged by visual inspection with a fiber microscope. First inspect the connector, then clean as required.

WARNING
Risk of eye injury

When inspecting a connector, ensure that light sources are off. The light source used in fiber optic cables can damage your eyes.

- If you suspect only the possibility of dust particles (for example, which can occur when a connector is left uncapped in a clean environment), use high-quality canned air or a reel cleaner (for example, a Cletop) to clean the connector. A reel cleaner is a good choice for making sure that no dust contaminates the connector.
- If the connector is visibly dirty or suspected to be contaminated by chemicals (for example, matching gel), use high-quality alcohol and

Copyright © 2008, Nortel Networks

canned air to clean the connector (see the following procedure). This is the most thorough cleaning method. In some cases, a reel cleaner may suffice.

Always keep in mind that the more surface manipulation applied to the connector, the more likely the connector to become damaged.

When you insert a connector ferrule into a connector or adapter, ensure that the ferrule tip does not touch the outside of the mating connector or adapter. This can produce scratches and dirt deposits on the connector.

To help prevent them from collecting dust, ensure connectors are covered when not in use. To avoid the transfer of oil or other contaminants from your fingers to the end face of the ferrule, handle connectors with care. Do not touch the connector end face.

Cleaning single connectors

Clean connectors so that the optical signal is minimally attenuated by the connector.

This procedure is appropriate when more than dust contamination is suspected.

Prerequisites

- lens-grade, lint-free tissue (for example, Kimwipes)
- optical-grade isopropyl alcohol (IPA) (98% or more pure)
- high-quality canned compressed air with extension tube Compressed air must be free of dust, water and oil, or filmy deposits or scratches on the surface of the connector can result.
- fiber optic microscope for inspecting connectors

WARNING
Risk of eye injury

When inspecting a connector, ensure that light sources are off. The light source used in fiber optic cables can damage your eyes.

To avoid getting debris in your eyes, wear safety glasses when working with the canned air duster.

To avoid eye irritation on contact, wear safety glasses when working with isopropyl alcohol.

Procedure steps

Copyright © 2008, Nortel Networks

Step	Action
1	Remove dust or debris by applying canned air to the cylindrical and end-face surfaces of the connector.
2	Gently wipe the cylindrical and end-face surfaces with a tissue dampened with optical-grade isopropyl alcohol.
3	Gently wipe the cylindrical and end-face surfaces with a dry tissue.

ATTENTION
Do not let the IPA evaporate; wipe it dry immediately. Alcohols can leave a residue that is difficult to remove.

4	Dry the connector surfaces by applying canned air.
5	Inspect the connector to ensure it is clean and undamaged. To prevent contamination, do not touch the connector surfaces after cleaning; and cover connectors with dust caps if you are not going to use them right away.

—End—

Cleaning duplex connectors

Clean connectors so that the optical signal is minimally attenuated by the connector.

This procedure is appropriate when more than dust contamination is suspected.

Prerequisites

- lens-grade, lint-free tissue (for example, Kimwipes)
- optical-grade isopropyl alcohol (IPA) (98% or more pure)
- high-quality canned compressed air with extension tube Compressed air must be free of dust, water and oil, or filmy deposits or scratches on the surface of the connector can result.
- fiber optic microscope for inspecting connectors

Copyright © 2008, Nortel Networks

WARNING
Risk of eye injury

When inspecting a connector, ensure that light sources are off. The light source used in fiber optic cables can damage your eyes.

To avoid getting debris in your eyes, wear safety glasses when working with the canned air duster.

To avoid eye irritation on contact, wear safety glasses when working with isopropyl alcohol.

Procedure steps

Step	Action
1	To remove or retract the shroud, do one of the following. • On removable shroud connectors, hold the shroud on the top and bottom at the letter designation, apply medium pressure, and pull it free from the connector body. Do not discard the shroud. • On retractable shroud connectors, hold the shroud in its retracted position.
2	Remove dust or debris by applying canned air to the cylindrical and end-face surfaces of the connector.
3	Gently wipe the cylindrical and end-face surfaces of both ferrules using a tissue saturated with optical-grade isopropyl alcohol.
4	Gently wipe the cylindrical and end-face surfaces with a dry tissue.
5	Blow dry the connector surfaces with canned air.
6	Blow dry the connector surfaces with canned air.
7	Inspect the connector to ensure it is clean and undamaged.
8	Using care to not touch the clean ferrules, gently push the shroud back onto the connector until it seats and locks in place.

ATTENTION
Do not let the IPA evaporate; wipe it dry immediately. Alcohols can leave a residue that is difficult to remove.

—End—

Copyright © 2008, Nortel Networks

Cleaning receptacles

Clean connector receptacles or ports so that the optical signal is minimally attenuated by the connection.

Prerequisites

- optical-grade isopropyl alcohol (IPA) (98% or more pure)
- cleaning swabs (also called cleaning sticks or wands)
- high-quality canned compressed air with extension tube Compressed air must be free of dust, water and oil, or filmy deposits or scratches on the surface of the connector can result.

CAUTION
Risk of equipment damage

To avoid contamination, optical ports should only be cleaned when there is evidence of contamination or reduced performance, or during their initial installation.

To prevent oil contamination, use only high-quality canned compressed air.

Do not allow the air extension tube to touch the bottom of the optical port.

Procedure steps

Step	Action
1	Remove dust or debris by blowing canned air into the optical port of the device using the canned air extension tube.
2	Clean the optical port by inserting a wand moistened with alcohol into the receptacle and rotating it. Each cleaning wand should only be used to clean one optical port.
3	Dry the optical port by inserting a dry wand into the receptacle and rotating it.

ATTENTION
Do not let the IPA evaporate; wipe it dry immediately. Alcohols can leave a residue that is difficult to remove.

Copyright © 2008, Nortel Networks

4 Remove any lint by blowing compressed air into the optical port.

5 Reconnect the optical connector and check for proper function.

If you are not reinstalling the connector, be sure to use a protective cap.

If problems persist, ensure that the connector or receptacle are not damaged.

—End—

Product safety warnings and information

The products described in this guide meet requirements of:

IEC 60950 3rd edition
CSA 22.2 No. 60950 3rd edition
UL 60950 3rd edition
EN60950 3rd edition
EN60825-1, +A11, +A2

ESD and installation caution messages

CAUTION
Risk of equipment damage
Only trained personnel can install this product.

Laser safety warnings

This section provides laser safety warnings and translations.

8769EB

Copyright © 2008, Nortel Networks

Electromagnetic interference compliance

WARNING
Risk of electromagnetic radiation exposure
Use of controls or adjustments, or performance of procedures other than those specified herein can result in hazardous radiation exposure.

The products described in this guide meet requirements of:

FCC Part 15, Subparts A and B, Class A
EN55022: 1998/CISPR22:1997), Class A
General License VDE 0871, Class B
(AmtsblVfg No. 243/1991, Vfg 46/1992) VCCI Class A ITE
EN55024:1998/CISPR24:1997

Federal Communications Commission (FCC) Compliance Notice: Radio Frequency Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy. If it is not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to take whatever measures may be necessary to correct the interference at their own expense.

European EN 55 022 statement

This is to certify that the Nortel Networks optical routing system is shielded against the generation of radio interference in accordance with the application of Council Directive 89/336/EEC, Article 4a. Conformity is declared by the application of EN 55 022 Class A (CISPR 22).

CAUTION
Risk of radio interference
This is a Class A product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take appropriate measures.

Copyright © 2008, Nortel Networks

ATTENTION

Achtung:
Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten, in welchen Fällen der Benutzer für entsprechende Gegenmaβnahmen verantwortlich ist.

ATTENTION

Ceci est un produit de Classe A. Dans un environnement domestique, ce produit risque de créer des interférences radioélectriques, il appartiendra alors à l'utilisateur de prendre les mesures spécifiques appropriées.

European EC Declaration of Conformity

These product conforms to the provisions of the R&TTE Directive 1999/5/EC.

Japan/Nippon Voluntary Control Council for Interference (VCCI) statement

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

Taiwan Bureau of Standards, Metrology and Inspection (BSMI) Statement

警告使用者:

這是甲類的資訊產品, 在居住的環境中使用時, 可能會造成射頻干擾, 在這種情況下, 使用者會被要求採取某些適當的對策

Canadian Department of Communications Radio Interference Regulations

This digital apparatus does not exceed the Class A limits for radio-noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications.

Copyright © 2008, Nortel Networks

Règlement sur le brouillage radioélectrique du ministère des Communications

Cet appareil numérique respecte les limites de bruits radioélectriques visant les appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique du ministère des Communications du Canada.

Canadian Department of Communications Radio Interference Regulations

This digital apparatus does not exceed the Class B limits for radio-noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications.

Règlement sur le brouillage radioélectrique du ministère des Communications

Cet appareil numérique respecte les limites de bruits radioélectriques visant les appareils numériques de classe B prescrites dans le Règlement sur le brouillage radioélectrique du ministère des Communications du Canada.

Copyright © 2008, Nortel Networks

Copyright © 2008, Nortel Networks

Small form factor pluggable transceivers

This section describes how to select and install small form factor pluggable (SFP) transceivers.

Use an SFP to interface a device motherboard to a fiber optic or unshielded twisted pair network cable. The SFPs described in this section provide Ethernet at 1 gigabit per second (Gbit/s).

Navigation

- "Selecting an SFP" (page 23)
- "Installing an SFP" (page 27)
- "Removing an SFP" (page 29)
- "SFP specifications" (page 41)

Selecting an SFP

Use an SFP transceiver to interface a device motherboard to a fiber optic or unshielded twisted pair network cable. Select the appropriate transceiver to provide the required reach.

Procedure steps

Step	Action
1	Determine the required reach. Depending on the product, SFPs are available for cable distances of up to 100 meters (m), 550 m, 10 kilometers (km), 40 km, 70 km, and 120 km.
2	Determine the required media and connector type. Fiber optic cable is required for any reach over 100 m.

Copyright © 2008, Nortel Networks

Possible media include CAT5, single mode fiber, and multimode fiber. Possible connectors include LC (Lucent optical connector), MT-RJ, and RJ-45.

3 If the media is optical fiber, determine any wavelength restrictions or requirements.

To expand available bandwidth on a common optical fiber, use CWDM SFPs.

4 Determine if digital diagnostic monitoring (DDM) is required.

Not all SFPs or products support DDM.

5 Use the following job aids to determine the appropriate SFP for your application.

—End—

Procedure job aid: SFPs and common applications

The following table describes the reach provided by various SFPs. This table is informational only—not all Nortel Ethernet switching and routing products support all the SFPs listed here.

Table 1
SFPs and common applications

SFP model	Common application
1000BASE-T	Lowest-cost Gigabit Ethernet solution. Up to 100 m reach over Category 5 (CAT5) unshielded twisted pair (UTP).
1000BASE-SX	Well-suited for campus local area networks (LAN) and intrabuilding links. Up to 275 or 550 m reach (fiber-dependent) over a fiber pair.
1000BASE-LX	Up to 10 km reach over a single mode fiber (SMF) pair. Up to 550 m reach over a multimode fiber (MMF) pair.
1000BASE-XD	Up to 40 km reach over a single mode fiber pair.
1000BASE-ZX	Up to 70 km reach over a single mode fiber pair.
1000BASE-BX	Up to 10 km reach. Bidirectional over one single mode fiber.
1000BASE-EX	Up to 120 km reach over a single mode fiber pair.

Procedure job aid: SFP models

SFPs are hot-swappable input/output enhancement components designed for use with Nortel products to allow Gigabit Ethernet ports to link with other Gigabit Ethernet ports over various media types.

Copyright © 2008, Nortel Networks

The SFPs described in this section do not have Digital Diagnostic Interface capability, and are RoHS -E5 compliant.

CWDM SFPS are also supported. CWDM technology consolidates multiple optical channels on a common optical fiber. CWDM uses multiple wavelengths to expand available bandwidth.

CWDM SFPs are designed to support high speed data communications for Metropolitan Area Networks (MANs). The system uses a grid of eight CWDM optical wavelengths in both ring and point-to-point configurations. All components are color-coded by wavelength.

ATTENTION

The attainable cable length can vary depending on the quality of the fiber optic cable used.

Table 2
SFP models without DDI support

Model and connector	Product number	Description
1000BASE-SX (LC)	AA1419013-E5	850 (nm), up to 275 or 550 m
1000BASE-SX (MT-RJ)	AA1419014-E5	850 nm, up to 275 or 550 m
1000BASE-LX (LC)	AA1419015-E5	1310 nm, up to 10 km
1000BASE-XD CWDM (LC)	AA1419025-E5 to AA1419032-E5	1470 nm to 1610 nm, up to 40 km
1000BASE-ZX CWDM (LC)	AA1419033-E5 to AA1419040-E5	1470 nm to 1610 nm, up to 70 km

For specifications for these SFPs, see "SFP specifications" (page 41).

Procedure job aid: SFP models with DDI support

Digital Diagnostic Monitoring (DDM) allows the Metro Ethernet Routing Switch 8600 to monitor SFP laser operating characteristics. Metro Ethernet Routing Switch 8600 support for Digital Diagnostic Interfaces (DDI—an interface that supports DDM) involves data collection and alarm and warning monitoring. Static data collection includes the SFP vendor information, DDI support information, and DDI alarm and warning threshold values. Dynamic data collection includes temperature, supply voltage, laser bias current, transmit power, and receive power. DDM works at any time during active laser operation without affecting data traffic.

The warning and alarm status bits are only checked during initialization and during requests for dynamic data. If an alarm or warning is asserted or cleared, a message is logged and a trap is generated. DDM warning

Copyright © 2008, Nortel Networks

and alarm messages are mapped into WARNING and FATAL message categories for system logging purposes. If an alarm or warning is generated, the software does not automatically shut down the port.

CWDM SFPs are also supported. CWDM SFPs are designed to support high-speed data communications. A CWDM system uses a grid of wavelengths to provide multiple channels for both ring and point-to-point configurations. All components are color-coded by wavelength.

Any DDM SFP can be used in any Metro Ethernet Services Unit 1800 or 1850 device or Metro Ethernet Routing Switch 8600 module that supports SFPs. The optical functions of the SFP are supported. Access to the DDI information is only provided for:

- Metro ESU 1850
- Metro Ethernet Routing Switch 8600 modules 8630 and 8683

Access to DDI information is not supported for:

- Metro ESU 1800
- Metro Ethernet Routing Switch 8600 module 8668

The SFPs described in this section are all RoHS -E6 compliant.

For information about DDM, see *Nortel Metro Ethernet Routing Switch 8600 Troubleshooting* (NN46220-701).

The following table lists and describes the Nortel SFP models with DDI capability. All the optical SFPs use LC connectors.

Table 3
SFP models with DDI capability

Model number and connector	Product number	Description
1000BASE-T (RJ-45)	AA1419043-E6	CAT5 UTP, up to 100 m. Note that because the 1000BASE-T device is all electrical, there is no need for DDI support.
1000BASE-SX	AA1419048-E6	850 nm, up to 275 or 550 m
1000BASE-LX	AA1419049-E6	1310 nm, up to 10 km
1000BASE-XD	AA1419050-E6	1310 nm, up to 40 km
1000BASE-XD	AA1419051-E6	1550 nm, up to 40 km
1000BASE-ZX	AA1419052-E6	1550 nm, up to 70 km
1000BASE-XD CWDM	AA1419053-E6 to AA1419060-E6	1470 nm to 1610 nm, up to 40 km

Copyright © 2008, Nortel Networks

Model number and connector	Product number	Description
1000BASE-ZX CWDM	AA1419061-E6 to AA1419068-E6	1470 nm to 1610 nm, up to 70 km
1000BASE-BX	AA1419069-E6, AA1419070-E6	Bidirectional 1310 nm and 1490 nm, up to 10 km
1000BASE-EX	AA1419071-E6	1550 nm, up to 120 km

For specifications for these SFPs, see "SFP specifications" (page 41).

Installing an SFP

Install an SFP to provide an interface between the switch and the network cable.

Installing an SFP takes about three minutes.

WARNING
Risk of eye injury by laser
Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables are connected to a light source.

Prerequisites

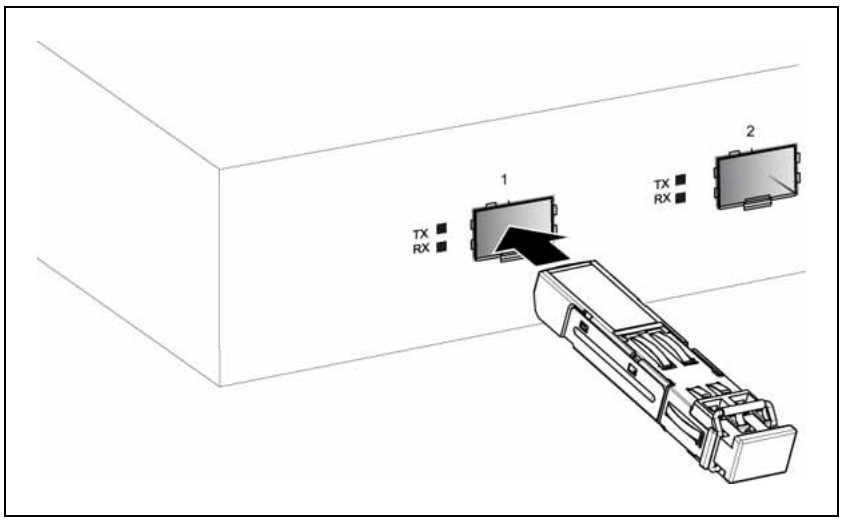
- Verify that the SFP is the correct model for your network configuration.

Procedure steps

Step	Action
1	Remove the SFP from its protective packaging.
2	Grasp the SFP between your thumb and forefinger.
3	As shown in the following figure, insert the device into the slot on the module. Apply a light pressure to the device until it clicks and locks into position.

CAUTION
Risk of equipment damage
SFPs are keyed to prevent incorrect insertion. If the SFP resists pressure, do not force it; turn it over, and reinsert it.

Copyright © 2008, Nortel Networks



4 Remove the dust cover from the optical bore and insert the fiber optic connector.

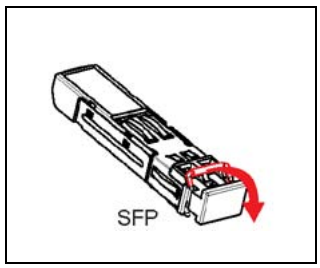
—End—

Procedure job aid: locking and extractor mechanisms

Depending on the transceiver manufacturer, your SFP transceiver can have various types of locking/extractor mechanisms.

The following figures shows a typical mechanisms used on SFP transceivers; other locking/extractor mechanisms exist, although they are not shown here. In Figure 1 "SFP with bail lock and extraction mechanism" (page 28), the SFP still has the bore plug installed. Pull the bail to release the device.

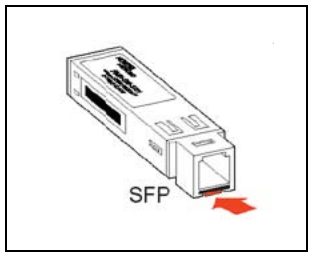
Figure 1
SFP with bail lock and extraction mechanism



The following figure shows the 1000BASE-SX MT-RJ SFP. Push the tab to release the device.

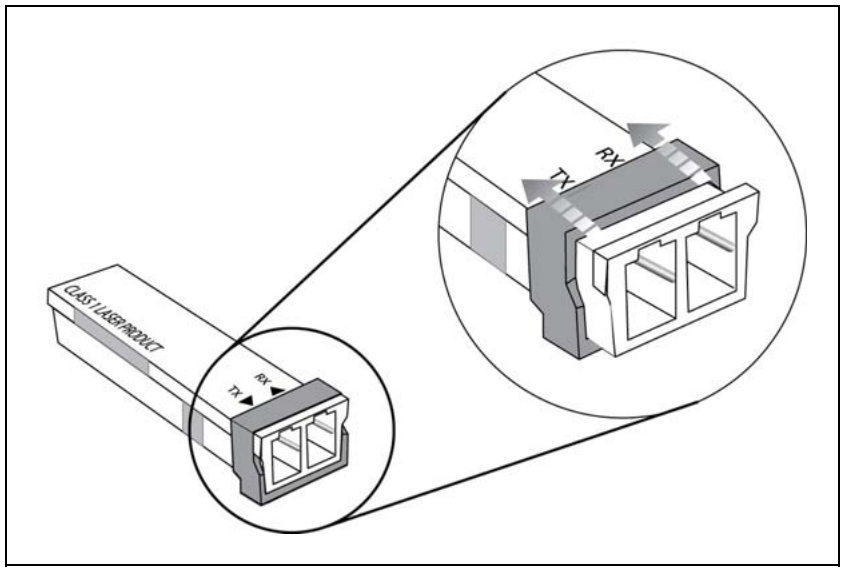
Copyright © 2008, Nortel Networks

Figure 2
1000BASE-SX MT-RJ SFP extraction mechanism



The following figure shows the wrap-around latch-type extraction mechanism. To remove the device, push the collar towards the module.

Figure 3
Wrap-around latch-type extraction mechanism



Removing an SFP

Remove an SFP to replace it or to commission it elsewhere.

WARNING
Risk of eye injury by laser
Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables are connected to a light source.

Copyright © 2008, Nortel Networks

Procedure steps

Step	Action
1	Disconnect the network fiber cable from the SFP connector.
2	Affix dust covers over the fiber optic bore and connector.
3	Depending on your SFP model, to release the SFP, press the locking/extractor mechanism. Your SFP locking/extractor mechanism can be different than the models shown.
4	Slide the SFP out of the module SFP slot. If the SFP does not slide easily from the module slot, use a gentle side-to-side rocking motion while firmly pulling the SFP from the slot.
5	Store the SFP in a safe place until needed.

ATTENTION
If you discard the SFP, be sure to dispose of it according to all national laws and regulations.

—End—

Copyright © 2008, Nortel Networks

Gigabit interface converters

This section describes how to install and remove Gigabit Interface Converters (GBIC).

Navigation

- "Selecting a GBIC" (page 31)
- "Installing a GBIC" (page 32)
- "Removing a GBIC" (page 33)
- "GBIC specifications" (page 55)

Selecting a GBIC

Use a GBIC to interface a device motherboard to a fiber optic or unshielded twisted pair network cable. Select the appropriate transceiver to provide the required reach.

Procedure steps

Step	Action
1	Determine the required reach. GBICs are available for cable distances of up to 100 meters (m), 550 m, 10 kilometers (km), 40 km, 70 km, and 120 km.
2	Determine the required media and connector type. Fiber optic cable is required for any reach over 100 m. Depending on the product, possible media include CAT5, single mode fiber, and multimode fiber. Possible connectors include SC (subscriber connector) type and RJ-45.
3	If the media is optical fiber, determine any wavelength restrictions or requirements. To expand available bandwidth on a common optical fiber, use Coarse Wavelength Division Multiplexing (CWDM) GBICs.

Copyright © 2008, Nortel Networks

4 Use the following job aids to determine the appropriate GBIC for your application.

—End—

Procedure job aid: GBIC models

GBICs are hot-swappable input/output enhancement components designed for use with Nortel products to allow Gigabit Ethernet ports to link with other Gigabit Ethernet ports over various media types. The following table describes supported GBICs. For specifications for these GBICs, see "GBIC specifications" (page 55).

ATTENTION

Attainable cable length can vary depending on the quality of the fiber optic cable used.

Table 4
GBIC models

Model and connector	Product number	Description
1000BASE-T (RJ-45)	AA1419041-E5	CAT5 unshielded twisted pair (UTP), up to 100 m
1000BASE-SX (SC)	AA1419001-E5	850 nanometers (nm), up to 275 or 550 m
1000BASE-LX (SC)	AA1419002-E5	1310 nm, up to 10 km
1000BASE-XD (SC)	AA1419003-E5	1550 nm, up to 50 km
1000BASE-ZX (SC)	AA1419004-E5	1550 nm, up to 70 km
1000BASE-EX CWDM (SC)	AA1419017-E5 to AA1419024-E5	1470 nm to 1610 nm, up to 120 km

Installing a GBIC

Install a GBIC to complete the transmission path.

Installing a GBIC takes about 3 minutes.

Prerequisites

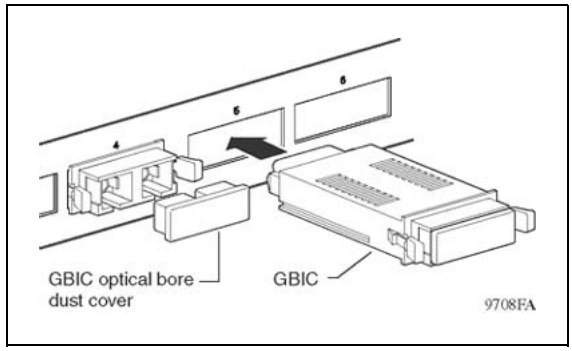
- Verify that the GBIC is the correct model for your network configuration.

Copyright © 2008, Nortel Networks

Procedure steps

CAUTION
GBICs are keyed to prevent incorrect insertion. If the GBIC resists pressure, do not force it; turn it over, and reinsert it.

Step	Action
1	Remove the GBIC from its protective packaging.
2	Grasp the GBIC between your thumb and forefinger.
3	Insert the GBIC into the slot on the front panel of the Gigabit Ethernet switching module.



4	Remove the dust cover and insert the fiber optic connector.

—End—

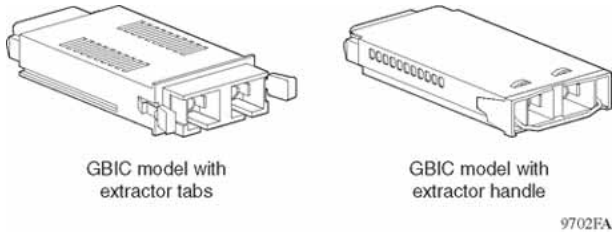
Removing a GBIC

Remove a GBIC to replace it or to commission it elsewhere.

Procedure steps

Step	Action
1	Disconnect the network fiber cable from the GBIC connector.
2	Attach a dust cover over the fiber optic bore.
3	Depending on your GBIC model, grasp the extraction tabs located on either side of the GBIC with your thumb and forefinger, or lift the extractor handle attached to the GBIC.

Copyright © 2008, Nortel Networks



4 Slide the GBIC out of the Gigabit Ethernet module slot.

If the GBIC does not slide easily from the module slot, use a gentle side-to-side rocking motion while firmly pulling the GBIC from the slot.

5 Store the GBIC in a safe place until needed.

ATTENTION

If you discard the GBIC, be sure to dispose of it according to all national laws and regulations.

—End—

ATTENTION

When you contact a Nortel service representative for troubleshooting purposes, you must have the following information available:

- Nortel serial number
- Manufacturer's code
- Interface type
- GBIC part number

Copyright © 2008, Nortel Networks

10 Gigabit small form factor pluggable transceivers

This section describes how to install and remove 10 Gigabit Small Form Factor Pluggable (XFP) transceivers, and lists some technical specifications for the supported XFP models.

ATTENTION

Nortel recommends that you only use Nortel qualified XFPs. If you do choose to use other vendor XFPs, be aware that Nortel does not support the use of other XFPs.

Navigation

- "Selecting an XFP" (page 35)
- "Installing an XFP" (page 37)
- "Removing an XFP" (page 38)
- "XFP specifications" (page 65)

Selecting an XFP

Use an XFP transceivers to interface a device motherboard to a fiber optic cable. Select the appropriate transceiver to provide the required reach.

Procedure steps

Step	Action
1	Determine the required reach. Depending on the product, XFPs are available for cable distances of up to 300 meters (m), 10 kilometers (km), 40 km, and 80 km.
2	Determine any wavelength restrictions or requirements.
3	Use the following job aids to determine the appropriate XFP for your application.

Copyright © 2008, Nortel Networks

—End—

Procedure job aid: XFP models

XFPs are hot-swappable input/output enhancement components designed for use with Nortel products to allow 10 Gigabit Ethernet ports to link with other 10 Gigabit Ethernet ports.

All Nortel XFPs use LC connectors (Lucent optical connectors) to provide precision keying and low interface losses.

The following table lists and describes the Nortel XFP models. For specifications for these XFPs, see "XFP specifications" (page 65).

ATTENTION

You can configure the XFP to operate in either LAN or WAN mode, depending on the module (8683XLR is a LAN-only module, and 8683XZR is a LAN/ WAN module). Model numbers ending in *R* denote a LAN interface; model numbers ending in *W* denote a WAN interface.

CAUTION

Nortel recommends that you install only one 10GBASE-ZR/ZW XFP per module due to cooling limitations on the 8683XLR and 8683XZR modules. Nortel further recommends the installation of the XFP only in port 1. You can install a 10GBASE-SR, -LR/LW, or -ER/EW in one or both of the remaining ports.

Table 5
XFP models

Model number	Product number	Description
10GBASE-SR	AA1403005-E5	850 nanometers (nm). The range is up to: • 22 m using 62.5 micrometer (µm), 160 megaHertz times km (MHz-km) MMF • 33 m using 62.5 µm, 200 MHz-km MMF • 66 m using 62.5 µm, 500 MHz-km MMF • 82 m using 50 µm, 500 MHz-km MMF • 300 m using 50 µm, 2000 MHz-km MMF
10GBASE-LR/LW	AA1403001-E5	1310 nm SMF. The range is up to 10 km.
10GBASE-ER/EW	AA1403003-E5	1550 nm SMF. The range is up to 40 km.
10GBASE-ZR/ZW	AA1403006-E5	1550 nm SMF. The range is up to 80 km.

Copyright © 2008, Nortel Networks

Installing an XFP

Install an XFP to provide a 10 Gigabit Ethernet interface between the switch and other network devices.

Installing an XFP takes about three minutes.

WARNING
Risk of eye injury by laser
Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables are connected to a light source.

CAUTION
Risk of equipment damage
Nortel recommends that you install only one 10GBASE-ZR/ZW per module due to cooling limitations on the 8683XLR and 8683XZR modules. Nortel further recommends the installation of the XFP only in port 1. You can install a 10GBASE-SR, -LR/LW, or -ER/EW in one or both of the remaining ports.

Prerequisites

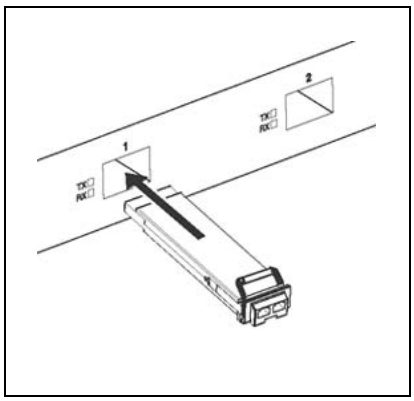
- Verify that the XFP is the correct model for your network configuration.

Procedure steps

Step	Action
1	Remove the XFP from its protective packaging.
2	Grasp the XFP between your thumb and forefinger.
3	Insert the XFP into the XFP slot on the module. Apply a light pressure to the XFP until the device clicks and locks into position in the module.

CAUTION
Risk of equipment damage
XFPs are keyed to prevent incorrect insertion. If the XFP resists pressure, do not force it; turn it over, and reinsert it.

Copyright © 2008, Nortel Networks



4 Remove the dust cover from the XFP optical bores and insert the fiber optic cable.

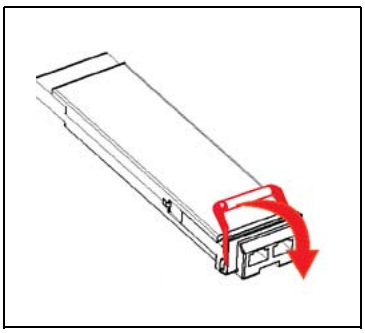
—End—

Procedure job aid: locking and extractor mechanisms

Depending on the transceiver manufacturer, your XFP transceiver can have various types of locking/extractor mechanisms.

The following figure shows a typical bail-type mechanism used on XFP transceivers. Pull the bail down to release the device.

Figure 4
XFP with bail lock and extraction mechanism



Removing an XFP

Remove an XFP to replace it or to commission it elsewhere.

Copyright © 2008, Nortel Networks

WARNING
Risk of eye injury by laser
Fiber optic equipment can emit laser or infrared light that can injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables are connected to a light source.

Procedure steps

Step	Action
1	Disconnect the network fiber cable from the XFP connector.
2	Affix a dust cover over the optical connector.
3	Pull the bail mechanism on the XFP to release the XFP.
4	Slide the XFP out of the module XFP slot. If the XFP does not slide easily from the module slot, use a gentle side-to-side rocking motion while firmly pulling the XFP from the slot.
5	Replace the port dust cover or EMI plug in the module.
6	Store the XFP in a safe place until needed.

ATTENTION
If you discard the XFP, be sure to dispose of it according to all national laws and regulations.

—End—

Copyright © 2008, Nortel Networks

Copyright © 2008, Nortel Networks

SFP specifications

This section provides technical specifications for the supported small form factor pluggable (SFP) models. Use this information to aid in proper network design.

The specifications given in this section meet or exceed those specified in the applicable IEEE standards, where they exist.

In these specifications, unless otherwise noted, *receiver sensitivity* is defined as the minimum average input optical power for which the receiver is guaranteed to meet the bit error rate (BER) of 10^{-12}.

Navigation

- "SFP labels" (page 42)
- "General SFP specifications" (page 42)
- "1000BASE-T SFP specifications" (page 43)
- "1000BASE-SX (LC) SFP specifications" (page 43)
- "1000BASE-SX (MT-RJ) SFP specifications" (page 44)
- "1000BASE-LX SFP specifications" (page 44)
- "1000BASE-XD CWDM SFP specifications" (page 45)
- "1000BASE-ZX CWDM SFP specifications" (page 46)
- "1000BASE-SX DDI SFP specifications" (page 46)
- "1000BASE-LX DDI SFP specifications" (page 47)
- "1000BASE-XD DDI 1310 nm SFP specifications" (page 48)
- "1000BASE-XD DDI 1550 nm SFP specifications" (page 48)
- "1000BASE-ZX DDI SFP specifications" (page 49)
- "1000BASE-XD DDI CWDM SFP specifications" (page 50)
- "1000BASE-ZX DDI CWDM SFP specifications" (page 50)
- "1000BASE-BX DDI SFP specifications" (page 51)

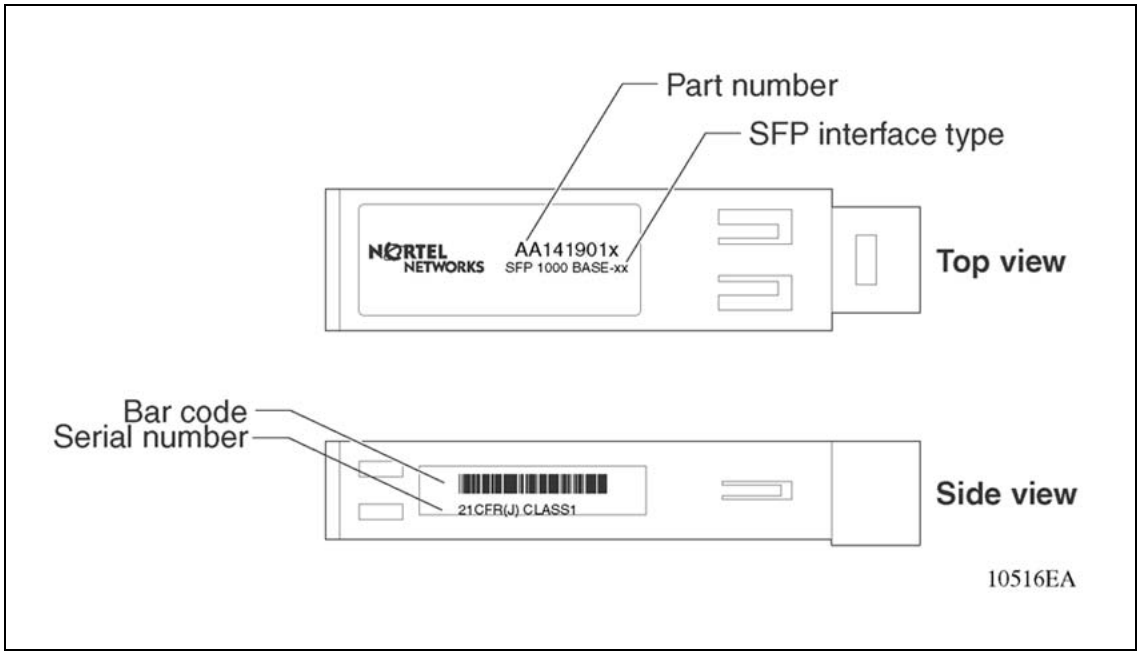
Copyright © 2008, Nortel Networks

- "1000BASE-EX DDI SFP specifications" (page 52)

SFP labels

The Nortel label on a typical SFP contains a Nortel serial number, a bar code, a manufacturer's code, an interface type, and a part number.

Figure 5
SFP label



General SFP specifications

The following table describes general SFP specifications.

Table 6
General SFP specifications

Parameter	Description
Dimensions (H x W x D)	13.4 x 8.50 x 56.4 millimeters (mm) 0.53 x 0.33 x 2.22 inches (in.) unless otherwise stated
Operating temperature	-5 to 85C for RoHS -E6 models 0 to 60C for RoHS -E5 models
Storage temperature	-40 to 85C
Maximum supply current	300 mA unless otherwise stated
Maximum power consumption	1.0 W unless otherwise stated

Copyright © 2008, Nortel Networks

1000BASE-T SFP specifications

The 1000BASE-T SFP provides Gigabit Ethernet connectivity using a single eight-pin RJ-45 connector. The 1000BASE-T SFP only operates at 1 gigabit per second (1 Gbit/s) and does not support 100BASE-T or 10BASE-T interfaces. The part number for this model is AA1419043-E6.

ATTENTION

You must disable autonegotiation before operating the 1000BASE-T SFP. By default, SFPs inserted into certain product-specific modules are set for Autonegotiation = True.

The maximum current requirement of the SFP is 375 milliamperes (mA) at 5 volts (V).

The following table describes the 1000BASE-T SFP specifications.

Table 7
IEEE 802.3z 1000BASE-T SFP specifications

Parameter	Specifications
Standards	IEEE 802.3z, IEEE 802.3ab
Connectors	RJ-45
Cabling	CAT5E or better UTP
Distance	Up to 100 m

1000BASE-SX (LC) SFP specifications

The 1000BASE-SX SFP provides 1000BASE-SX Gigabit Ethernet connectivity at 850 nm using multimode optical fiber. This SFP supports full-duplex operation only. The part number for this model is AA1419013-E5.

The following table describes standards, connectors, cabling, and distance for the 1000BASE-SX SFP.

Table 8
IEEE 802.3z 1000BASE-SX (LC) SFP specifications

Parameter	Specifications
Connectors	Duplex LC
Cabling	• 62.5 µm MMF optic cable • 50 µm MMF optic cable
Distance	• Up to 275 m using 62.5 µm MMF optic cable • Up to 550 m using 50 µm MMF optic cable
Wavelength	850 nanometers (nm)

Copyright © 2008, Nortel Networks

Parameter	Specifications
Link optical power budget	7.0 deciBels (dB)
Transmitter characteristics	
Launch power	-10 to -4.0 deciBels referenced to 1 milliwatt (dBm)
Receiver characteristics	
Receiver sensitivity	-17 dBm
Maximum input power	0 dBm

1000BASE-SX (MT-RJ) SFP specifications

The 1000BASE-SX (MT-RJ type) SFP provides Gigabit Ethernet connectivity using MT-RJ multimode fiber connectors. The following table describes standards, connectors, cabling, and distance for the 1000BASE-SX (MT-RJ type) SFP. The part number for this model is AA1419014-E5.

Table 9
IEEE 802.3z 1000BASE-SX (MT-RJ) SFP specifications

Parameter	Specifications
Connectors	Duplex MT-RJ
Cabling	• 62.5 µm MMF optic cable • 50 µm MMF optic cable
Distance	• Up to 275 m using 62.5 µm MMF optic cable • Up to 550 m using 50 µm MMF optic cable
Wavelength	850 nm
Link optical power budget	7.0 dB
Transmitter characteristics	
Launch power	-10 to -4.0 dBm
Receiver characteristics	
Receiver sensitivity	-17 dBm
Maximum input power	0 dBm

1000BASE-LX SFP specifications

The 1000BASE-LX SFP provides 1000BASE-LX Gigabit Ethernet connectivity at 1310 nanometers (nm) using single mode or multimode optical fiber. The 1000BASE-LX SFP supports full-duplex operation only. The part number for this model is AA1419015-E5.

The following table describes standards, connectors, cabling, and distance for the 1000BASE-LX SFP.

Copyright © 2008, Nortel Networks

Table 10
IEEE 802.3z 1000BASE-LX SFP specifications

Parameter	Specifications
Connectors	Duplex LC
Cabling	• 50 micrometer (µm) multimode fiber (MMF) • 62.5 µm multimode fiber • 9 µm single mode fiber (SMF)
Distance	• Up to 550 meters (m) using MMF • Up to 10 kilometers (km) using SMF
Wavelength	1310 nm
Link optical power budget	11.5 dB
Transmitter characteristics	
Launch power	-9.5 to -3.0 dBm
Receiver characteristics	
Receiver sensitivity	-20 dBm
Maximum input power	-3.0 dBm

1000BASE-XD CWDM SFP specifications

The part numbers of the 40 km models range from AA1419025-E5 to AA1419032-E5.

CAUTION
Risk of equipment damage
For the 40 km CWDM SFPs, a minimum attenuation of 4 dB must be present between the transmitter and receiver. To avoid receiver saturation, you must insert a minimum attenuation of 4 dB when you test the CWDM SFP in loopback mode, or use short runs of fiber with no intermediate CWDM OADM or CWDM OMUX.

Table 11
1000BASE-XD CWDM (40 km) SFP specifications

Parameter	Specifications
Connectors	Duplex LC
Cabling	SMF, 9 µm
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Operating temperature range	0 to 60C
Link optical power budget	17 dB

Copyright © 2008, Nortel Networks

Parameter	Specifications
Transmitter characteristics	
Launch power	-4.0 to 1.0 dBm
Receiver characteristics	
Receiver sensitivity	-21 dBm
Maximum input power	-3.0 dBm

1000BASE-ZX CWDM SFP specifications

The part numbers of the 70 km models range from AA1419033-E5 to AA1419040-E5.

CAUTION
Risk of equipment damage
For the 70 km CWDM SFPs, a minimum attenuation of 10 dB must be present between the transmitter and receiver.

Table 12
1000BASE-ZX CWDM (70 km) SFP specifications

Parameter	Specifications
Connectors	Duplex LC
Cabling	SMF, 9 µm
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Operating temperature range	0 to 60C
Link optical power budget	20 dB
Transmitter characteristics	
Launch power	-3.0 to 2.0 dBm
Receiver characteristics	
Receiver sensitivity	-23 dBm
Maximum input power	-3.0 dBm

1000BASE-SX DDI SFP specifications

The following table describes the 1000BASE-SX DDI SFP, which has a reach of up to 550 m using 50 µm MMF, and of 275 m using 62.5 µm MMF. This SFP operates at 850 nm. The part number of this SFP is AA1419048-E6.

Copyright © 2008, Nortel Networks

Table 13
1000BASE-SX SFP DDI (550 m) specifications

Parameter	Specifications
Maximum electrical power consumption	1 watt (W)
Connector	Duplex LC
Cabling	MMF
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Link optical power budget	7.5 dB
Transmitter characteristics	
Launch power	-9.5 to -4.0 dBm
Receiver characteristics	
Receiver sensitivity	-17 dBm
Maximum receiver power	0 dBm

1000BASE-LX DDI SFP specifications

This SFP can attain a reach of up to 10 km and operates at 1310 nm. The part number of this SFP is AA1419049-E6.

Table 14
1000BASE-LX DDI SFP specifications

Parameter	Specifications
Maximum electrical power consumption	1.0 watt (W)
Connectors	Duplex LC
Cabling	SMF, 9 µm
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Link optical power budget	9.5 dB
Transmitter characteristics	
Launch power	-9.5 to -3.0 dBm
Receiver characteristics	
Receiver sensitivity	-19.0 dBm
Maximum receiver power	-3.0 dBm

Copyright © 2008, Nortel Networks

1000BASE-XD DDI 1310 nm SFP specifications

The following table describes the 1000BASE-XD DDI SFP. This SFP operates at 1310 nm and has a reach of up to 40 km. The part number is AA1419050-E6.

Table 15
1000BASE-XD DDI 1310 nm SFP specifications

Parameter	Specifications
Maximum electrical power consumption	1.0 W
Connectors	Duplex LC
Cabling	SMF, 9 µm
Data rate	1.0 Gbit/s
Line rate (8B/10B) code	1.25 Gbit/s
Link optical power budget	18 dB
Transmitter characteristics	
Launch power	-4.5 to 0 dBm
Receiver characteristics	
Receiver sensitivity	-22.5 dBm
Maximum receiver power	0 dBm

1000BASE-XD DDI 1550 nm SFP specifications

The following table describes the 1000BASE-XD DDI SFP. This SFP operates at 1550 nm and has a reach of up to 40 km. The part number is AA1419051-E6.

CAUTION
Risk of equipment damage
To prevent damage to the optical receiver, ensure that at least 3 dB of attenuation is present between the transmit and receive ports.

Table 16
1000BASE-XD DDI 1550 nm SFP specifications

Parameter	Specification
Maximum electrical power consumption	1.0 W
Connectors	Duplex LC
Cabling	SMF, 9 µm
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s

Copyright © 2008, Nortel Networks

Parameter	Specification
Link optical power budget	22 dB
Maximum dispersion power penalty	2 dB at 40 km
Transmitter characteristics	
Launch power	-2.0 to 3.0 dBm
Receiver characteristics	
Receiver sensitivity	-24 dBm
Maximum receiver power	0 dBm

1000BASE-ZX DDI SFP specifications

The following table describes the 1000BASE-ZX DDI SFP. This SFP operates at 1550 nm and has a reach of up to 70 km. The part number is AA1419052-E6.

CAUTION
Risk of equipment damage
To prevent damage to the optical receiver, ensure that at least 5 dB of attenuation is present between the transmit and receive ports.

Table 17
1000BASE-ZX DDI 1550 nm SFP specifications

Parameter	Specifications
Maximum electrical power consumption	1.0 W
Connectors	Duplex LC
Cabling	SMF, 9 µm
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Link optical power budget	24 dB
Maximum dispersion power penalty	2 dB at 70 km
Transmitter characteristics	
Launch power	0 to 5 dBm
Receiver characteristics	
Receiver sensitivity	-24 dBm
Maximum receiver power	-0 dBm

Copyright © 2008, Nortel Networks

1000BASE-XD DDI CWDM SFP specifications

The following table describes specifications for 1000BASE-XD CWDM SFPs numbered AA1419053-E6 to AA1419060-E6.

CAUTION
Risk of equipment damage
To prevent damage to the optical receiver, ensure that at least 4 dB of attenuation is present between the transmit and receive ports.

Table 18
1000BASE-XD CWDM SFP DDI (40 km) specifications

Parameter	Specifications
Maximum electrical power consumption	1.0 W
Connectors	Duplex LC
Cabling	SMF, 9 µm
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Link optical power budget	17 dB
Maximum dispersion power penalty	1 dB at 40 km
Transmitter characteristics	
Launch power	-4.0 to 1.0 dBm
Receiver characteristics	
Receiver sensitivity	-21 dBm
Maximum receiver power	-3.0 dBm

1000BASE-ZX DDI CWDM SFP specifications

The following table describes specifications for CWDM SFPs numbered AA1419061-E6 to AA1419068-E6.

CAUTION
Risk of equipment damage
To prevent damage to the optical receiver, ensure that at least 8 dB of attenuation is present between the transmit and receive ports.

Table 19
1000BASE-ZX CWDM SFP DDI (70 km) specifications

Parameter	Specifications
Maximum electrical power consumption	1.0 W

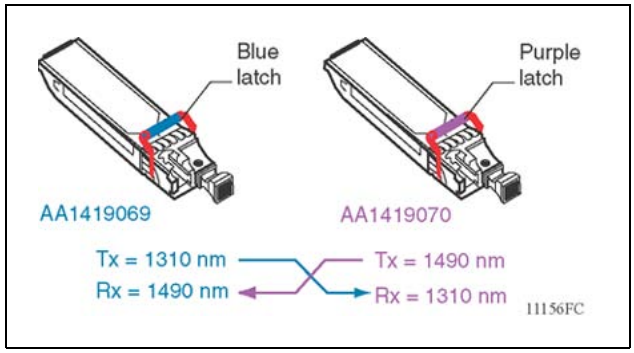
Copyright © 2008, Nortel Networks

Parameter	Specifications
Connectors	Duplex LC
Cabling	SMF, 9 µm
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Link optical power budget	24 dB
Maximum dispersion power penalty	2 dB at 70 km
Transmitter characteristics	
Launch power	0 to 5.0 dBm
Receiver characteristics	
Receiver sensitivity	-24 dBm
Maximum receiver power	-3.0 dBm

1000BASE-BX DDI SFP specifications

The 1000BASE-BX bidirectional SFPs (part numbers AA1419069-E6 and AA1419070-E6) provide Gigabit Ethernet connectivity over a single fiber.

Figure 6
1000BASE-BX



As shown in the previous figure, the transmit (Tx) and receive (Rx) paths share the same fiber by using two different wavelengths. One model transmits at 1310 nm and receives at 1490 nm, while the mating model transmits at 1490 nm and receives at 1310 nm. You can only connect a mating pair.

You can use 1000BASE-BX SFPs to double the number of your fiber links. For example, if you have 20 installed fiber pairs with 20 conventional ports connected, you can use 1000BASE-BX SFPs to expand to 40 ports, using the same fiber.

Copyright © 2008, Nortel Networks

The long wavelength optical transceivers used in these models provide variable distance ranges using single mode fiber optic cabling.

The following table describes standards, connectors, cabling, and distances for the 1000BASE-BX SFP.

Table 20
IEEE 802.3ah 1000BASE-BX10 SFP specifications

Parameter	Specifications
Connectors	Single-fiber LC
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Distance	Up to 10 km
Wavelength	1310 nm and 1490 nm
Link optical power budget	11.0 dB
Maximum transmitter and dispersion power penalty	3.3 dB
Transmitter characteristics	
Maximum launch power	-3.0 dBm
Minimum launch power	-9.0 dBm
Receiver characteristics	
Maximum receiver sensitivity	-19.5 dBm
Maximum input power (maximum average receive power)	-3.0 dBm

1000BASE-EX DDI SFP specifications

The following table describes the 1000BASE-EX DDI SFP. This SFP operates at 1550 nm and has a reach of up to 120 km. The part number of this SFP is AA1419071-E6.

CAUTION
Risk of equipment damage
To prevent damage to the optical receiver, ensure that at least 14 dB of attenuation is present between the transmit and receive ports.

To attain the BER of 10^{-12}, the minimum attenuation between the transmit and receive ports is 15 dB.

Copyright © 2008, Nortel Networks

Table 21
1000BASE-EX DDI SFP specifications

Parameter	Specifications
Maximum electrical power consumption	1.2 W
Connectors	Duplex LC
Cabling	SMF, 9 µm
Data rate	1.0 Gbit/s
Line rate (8B/10B code)	1.25 Gbit/s
Link optical power budget	30 dB
Maximum dispersion power penalty	2.0 dB at 120 km
Transmitter characteristics	
Launch power	0 to 5.0 dBm
Receiver characteristics	
Receiver sensitivity	-30 dBm
Maximum receiver power	-9.0 dBm

Copyright © 2008, Nortel Networks

Copyright © 2008, Nortel Networks

GBIC specifications

This section provides technical specifications for the supported Gigabit interface converter (GBIC) models. Use the specifications to help ensure proper network operation.

Navigation

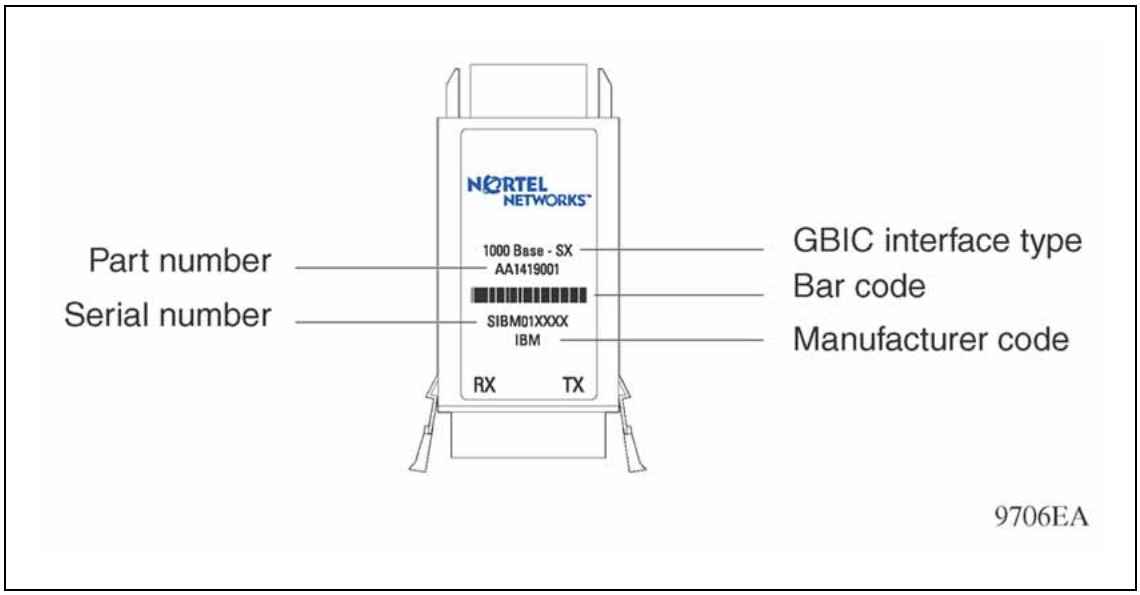
- "GBIC labels" (page 55)
- "GBIC physical specifications" (page 56)
- "1000BASE-T GBIC specifications" (page 56)
- "1000BASE-SX GBIC specifications" (page 57)
- "1000BASE-LX GBIC specifications" (page 58)
- "1000BASE-XD GBIC specifications" (page 60)
- "1000BASE-ZX GBIC specifications" (page 60)
- "1000BASE-EX CWDM GBIC specifications" (page 61)

GBIC labels

As shown in the following figure, the Nortel label on a typical GBIC contains a Nortel serial number, a bar code, a manufacturer's code, an interface type, and a part number.

Copyright © 2008, Nortel Networks

Figure 7
GBIC label



GBIC physical specifications

The following table describes general GBIC specifications. GBIC ports for both multimode (MMF) and single mode fiber (SMF) have SC-type connectors and a minimum cable distance of 2 meters (m).

Table 22
GBIC physical specifications

Parameter	Specifications
Dimensions (H x W x D)	0.39 x 1.2 x 2.6 inches (in.) 1.0 x 3.0 x 6.5 centimeters (cm)
Connectors	• Multimode: SC • Single mode: SC • CAT5 RJ-45

1000BASE-T GBIC specifications

The 1000BASE-T GBIC provides Gigabit Ethernet connectivity using a single eight-pin RJ-45 connector. The 1000BASE-T GBIC operates at 1 gigabit per second (Gbit/s) and does not support 100BASE-T or 10BASE-T interfaces.

The part number of this GBIC is AA1419041-E5 for the Ethernet Routing Switch and the Metro Ethernet Routing Switch.

Copyright © 2008, Nortel Networks

ATTENTION
You must disable autonegotiation before operating the 1000BASE-T GBIC. By default, GBICs inserted into certain product-specific modules are set for Autonegotiation = True. If autonegotiation does not work initially, Nortel recommends that you reconfigure the switch to use a fixed-speed setting of 1000 Mbit/s, full-duplex, on both sides.

The maximum current requirement of the GBIC is 375 milliamperes (mA) at 5 volts (V).

The following table describes the 1000BASE-T GBIC.

Table 23
1000BASE-T GBIC specifications

Parameter	Specifications
Standards	IEEE 802.3z, IEEE 802.3ab
Connectors	RJ-45
Cabling	CAT5 unshielded twisted pair (UTP)
Distance	Up to 100 m

1000BASE-SX GBIC specifications

The 1000BASE-SX GBIC provides 1000BASE-SX Gigabit Ethernet connectivity using SC duplex multimode fiber connectors. This GBIC supports full-duplex operation only. The part number of this GBIC is AA1419001-E5.

The following table describes standards, connectors, cabling, and distance for the 1000BASE-SX GBIC.

CAUTION
When multimode fiber is used in long-distance applications, external, removable, mode-conditioning patch cords may be required to prevent differential mode delay (DMD). Excessive DMD can cause an increase in the bit error rate (BER). You can order mode conditioning patch cords through Nortel:

- SC-SC Mode-Conditioning Patch Cord 62.5/125 (part number AA0018035)
- SC-SC Mode-Conditioning Patch Cord 50/125 (part number AA0018036)

Copyright © 2008, Nortel Networks

CAUTION
To prevent damage to the optical receiver, ensure that at least 10dB of attenuation is present between the transmit and receive ports.

Table 24
IEEE 802.3z 1000BASE-SX GBIC specifications

Parameter	Specifications
Connectors	Duplex SC
Cabling	• 62.5 micrometer (µm) MMF • 50 µm MMF
Distance	• up to 275 m using 62.5 µm MMF • up to 550 m using 50 µm MMF
Wavelength	850 nanometers (nm)
Link optical power budget	7.0 dB
Transmitter characteristics	
Launch power	-10 to -4.0 deciBels referenced to 1 milliwatt (dBm)
Receiver characteristics	
Receiver sensitivity	-17 dBm
Maximum input power	0 dBm

1000BASE-LX GBIC specifications

The 1000BASE-LX GBIC provides 1000BASE-LX Gigabit Ethernet connectivity using SC duplex fiber connectors. The long wavelength optical transceivers used in the LX model provide variable distance ranges using both multimode and single mode fiber cabling. The 1000BASE-LX GBIC supports full-duplex operation only. The part number of this GBIC is AA1419002-E5.

Copyright © 2008, Nortel Networks

CAUTION
When multimode fiber is used in long-distance applications, external, removable, mode-conditioning patch cords may be required to prevent differential mode delay (DMD). Excessive DMD can cause an increase in the bit error rate (BER). You can order mode conditioning patch cords through Nortel:

- SC-SC Mode-Conditioning Patch Cord 62.5/125 (part number AA0018035)
- SC-SC Mode-Conditioning Patch Cord 50/125 (part number AA0018036)

The following table describes standards, connectors, cabling, and distance for the 1000BASE-LX GBIC.

Table 25
IEEE 802.3z 1000BASE-LX GBIC specifications

Parameter	Specifications
Standards	IEEE 802.3z, 1000BASE-LX
Connectors	Duplex SC
Cabling	• 62.5 µm MMF • 50 µm MMF • 10 µm SMF
Distance	• up to 550 m using 62.5 µm MMF • up to 550 m using 50 µm MMF • up to 10 km using 10 µm SMF
Wavelength	1310 nm
Link optical power budget	10.5 deciBels (dB)
Transmitter characteristics	
Launch power	-9.5 to -3.0 dBm
Receiver characteristics	
Receiver sensitivity	-20 dBm
Maximum input power	-3.0 dBm

Copyright © 2008, Nortel Networks

1000BASE-XD GBIC specifications

The 1000BASE-XD GBIC provides Gigabit Ethernet connectivity using SC duplex single mode fiber connectors. High-performance optical transceivers enable Gigabit Ethernet link distances of up to 50 kilometers (km) over single mode fiber. The GBIC operates in full-duplex mode only. The part number of this GBIC is AA1419003-E5.

CAUTION
To prevent damage to the optical receiver, ensure that at least 3 dB of attenuation is present between the transmit and receive ports.

The following table describes standards, connectors, cabling, and distance for the 1000BASE-XD GBIC.

Table 26
IEEE 802.3z 1000BASE-XD GBIC specifications

Parameter	Specifications
Connectors	Duplex SC single mode
Cabling	SMF
Distance	Up to 50 km
Link optical power budget	17 dB
Transmitter characteristics	
Wavelength	1550 ± 10 nm
Launch power	-5.0 to 0 dBm
Receiver characteristics	
Wavelength	1200 to 1620 nm
Receiver sensitivity	-22 dBm
Maximum input power	-3.0 dBm

1000BASE-ZX GBIC specifications

The 1000BASE-ZX GBIC provides Gigabit Ethernet connectivity using SC duplex single mode fiber connectors. High-performance optical transceivers enable Gigabit Ethernet link distances up to 70 km over single mode fiber cable. The GBIC operates in full-duplex mode only. The part number of this GBIC is AA1419004-E5.

Copyright © 2008, Nortel Networks

CAUTION
When shorter lengths of single mode fiber cable are used, there is a risk of overloading the receiver. It may be necessary to insert an in-line optical attenuator in the link to prevent overloading, as follows:

- Insert a 10 dB in-line optical attenuator between the fiber optic cable plant and the receiving port on the 1000BASE-ZX GBIC, at each end of the link, if the fiber optic cable span is less than 25 km.
- Insert a 5 dB in-line optical attenuator between the fiber optic cable plant and the receiving port on the 1000BASE-ZX GBIC, at each end of the link, if the fiber optic cable span is less than 50 km.

The following table describes standards, connectors, cabling, and distance for the 1000BASE-ZX GBIC.

Table 27
IEEE 802.3z 1000BASE-ZX GBIC specifications

Parameter	Specifications
Connectors	SC duplex
Cabling	SMF
Distance	Up to 70 km
Link optical power budget	22 dB
Transmitter characteristics	
Wavelength	1550 ± 10 nm
Maximum spectral width	0.2 nm
Launch power	0 to 5.0 dBm
Receiver characteristics	
Wavelength	1200 nm to 1620 nm
Receiver sensitivity	-22 dBm
Maximum input power	-3.0 dBm

1000BASE-EX CWDM GBIC specifications

This section provides technical specifications for the coarse wavelength division multiplexing (CWDM) 1000BASE-EX GBIC models. The part numbers of these GBICs range from AA1419017-E5 to AA1419024-E5.

Copyright © 2008, Nortel Networks

Table 28
CWDM GBIC specifications

Parameter	Specifications
Connectors	SC
Cabling	SMF, 9 µm
Data rate	0.0125 to 1.25 Gbit/s
Total system budget @ 1.25 Gbit/s BER < 10^{-9} w/PRBS 2^7-1	30 dB — Total system budget is defined as P_{out} - P_{in} - typical connector losses.
Data format	Electrical 8B/10B; optical 64B/66B
Operating temperature (case temperature)	0 to 70C
Storage temperature	-10 to 85C
Distance	Up to 120 km

The following table describes CWDM GBIC optical characteristics. In this table, the center wavelength range "x" is 1470, 1490, 1510, 1530, 1550, 1570, 1590, or 1610 nm.

Table 29
CWDM GBIC optical specifications

Parameter	Symbol	Minimum	Typical	Maximum
Transmitter center wavelength range (nm) for a case temperature of 0 to 70C	λ_c	(x-4)	(x+1)	(x+7)
Transmitter center wavelength range (nm) for a case temperature of 0 to 60C	λ_c	(x-4)	(x+1)	(x+6)
Wavelength temperature dependence			0.08 nm/C	
Side mode suppression ratio	SMSR	30 dB		
Transmitter optical output power (average power coupled into single mode fiber)	P_{out}	+2.0 dBm		+6.0 dBm
Transmitter extinction ratio	OMI	9 dB		
Transmitter eye opening (conforms with IEEE 802.3 and Fibre Channel Eye Masks)		60%		
Optical return loss	ORL	14 dB		
Input wavelength	λ_{in}	1450 nm		1620 nm

Copyright © 2008, Nortel Networks

Parameter	Symbol	Minimum	Typical	Maximum
Receiver optical input power (BER < 10^{-9} w/PRBS 2^7-1) at 1.25 Gb/s, 60C case temperature.	P_{in}	-30 dBm		-7 dBm
Receiver optical input power (BER < 10^{-9} w/PRBS 2^7-1) at 1.25 Gb/s, 70C case temperature.	P_{in}	-28 dBm		-7 dBm
Dispersion power penalty at 60 km			2.0 dB	
Dispersion power penalty at 100 km			3.0 dB	

The following table describes the CWDM GBIC electrical power interface specifications.

Table 30
Electrical power interface specifications

Parameter	Symbol	Minimum	Typical	Maximum
Supply current	I_s		250 mA	300 mA
Maximum voltage	V_{max}			6 V
Surge current	I_{surge}			350 mA
Input voltage	V_{cc}	4.75 V	5.00 V	5.25 V

Copyright © 2008, Nortel Networks

Copyright © 2008, Nortel Networks

XFP specifications

This section provides technical specifications for the supported 10 Gigabit SFP (XFP) models. Use these specifications to aid in network design. The specifications provided here are a subset of the IEEE 802.3ae and 802.3aq specifications. For more details, see these standards documents. All Nortel XFPs meet or exceed these standards.

ATTENTION

Nortel recommends that you only use Nortel-qualified XFPs. If you do choose to use other vendor XFPs, be aware that Nortel does not support the use of other XFPs.

Navigation

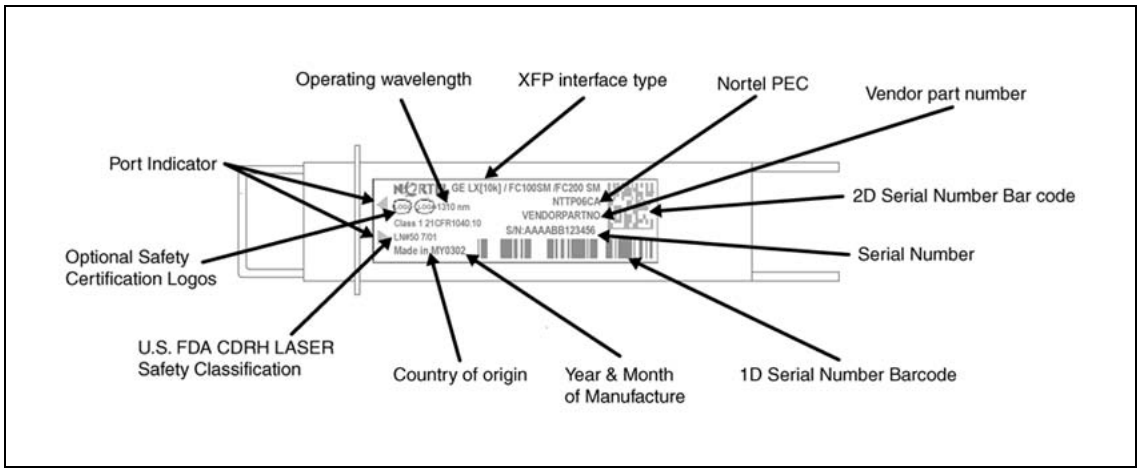
- "XFP labels" (page 65)
- "General XFP specifications" (page 66)
- "10GBASE-SR XFP specifications" (page 66)
- "10GBASE-LR/LW XFP specifications" (page 68)
- "10GBASE-ER/EW XFP specifications" (page 69)
- "10GBASE-ZR/ZW XFP specifications" (page 70)

XFP labels

The Nortel label on a typical XFP contains a Nortel serial number, a bar code, a manufacturer's code, an interface type, and a part number.

Copyright © 2008, Nortel Networks

Figure 8
XFP label



General XFP specifications

The following table describes general XFP specifications.

Table 31
General XFP specifications

Parameter	Specifications
Dimensions (H x W x D)	0.49 x 0.72 x 2.79 inches (in.) 12.5 x 18.35 x 71.1 millimeters (mm)
Connectors	LC ultra physical contact (UPC)
Storage temperature	-40 to 85C
Operating temperature	0 to 70C

10GBASE-SR XFP specifications

The 10GBASE-SR XFP provides 10 GbE service at 850 nm.

The following table lists the specifications for the 10GBASE-SR XFP. The part number of this XFP is AA1403005-E5.

For more information about the 10GBASE-SR XFP, including test and measurement information, see the IEEE 802.3ae standard.

CAUTION
Risk of equipment damage
To prevent damage to the optical receiver, ensure that at least 1 dB of attenuation is present between the transmit and receive ports.

Copyright © 2008, Nortel Networks

Table 32
IEEE 802.3ae 10GBASE-SR XFP specifications

Parameter	Specifications
Data rate	10.0 Gbit/s
Line rate (64B/66B code)	10.3125 gigabits per second (Gbit/s) ± 100 parts per million (ppm)
Mean Time Between Failures (MTBF)	675 000 hours
Center wavelength range	840 to 860 nanometers (nm), nominal 850 nm
Distance	Using 62.5 µm MMF optic cable: • 160 MHz-km fiber: 2 to 26 m • 200 MHz-km fiber: 2 to 33 m Using 50 µm MMF optic cable: • 400 MHz-km fiber: 2 to 66 m • 500 MHz-km fiber: 2 to 82 m • 2000 MHz-km fiber: 2 to 300 m
Link optical power budget	7.3 dB
Maximum transmitter and dispersion penalty	3.9 dB at 300 m
Transmitter characteristics	
Root-mean-square spectral width	0.05 to 0.40 nm
Launch power	-7.3 to -1.0 deciBels referenced to 1 milliwatt (dBm)
Maximum average launch power of OFF transmitter	-30 dBm
Minimum extinction ratio	3.0 dB
Maximum relative intensity noise $_{12}$OMA	-128 dB per Hertz (dB/Hz)
Maximum optical return loss tolerance	-12 dB
Receiver characteristics	
Average receive power for BER 10^{-12}	-9.9 to -1.0 dBm
Maximum average receive power for damage	0 dBm
Maximum receiver sensitivity in OMA	-11.1 dBm
Maximum receiver reflectance	-12 dB
Stressed receiver sensitivity in OMA	-7.5 dBm
Receiver electrical 3 dB upper cutoff frequency	12.3 gigaHertz (GHz)

Copyright © 2008, Nortel Networks

The stressed sensitivity values are for system level BER measurements, which include the effects of CDR circuits. Nortel recommends that you allocate at least 0.4 dB additional margin if you make component level measurements without the effect of CDR circuits.

10GBASE-LR/LW XFP specifications

The 10GBASE-LX SFP provides 10 GbE service at a nominal wavelength of 1310 nm. This XFP can attain link lengths of up to 10 km.

The following table lists the transmitter specifications for the 10GBASE-LR/LW XFP. The part number of this XFP is AA1403001-E5.

For more information about the 10GBASE-LX XFP, including test and measurement information, see the IEEE 802.3ae standard.

ATTENTION

You can configure the XFP to operate in either LAN (Ethernet) or WAN (SONET) mode, depending on the module (8683XLR is a LAN-only module, and 8683XZR is a LAN/ WAN module). Model numbers ending in *R* denote a LAN interface; model numbers ending in *W* denote a WAN interface.

Table 33
IEEE 802.3ae 10GBASE-LR/LW XFP specifications

Parameter	Specifications
MTBF	675 000 hours
Center wavelength range	1260 to 1355 nm; 1310 nm nominal
Distance	Up to 10 km
Link optical power budget	9.4 dB
Maximum transmitter and dispersion penalty	3.2 dB at 10 km
Transmitter characteristics	
Line rate (nominal)	10GBASE-LR 10.3125 Gbit/s ±100 ppm 10GBASE-LW 9.95328 Gbit/s ±20 ppm
Average launch power	-8.2 to 0.5 dBm
Minimum side mode suppression ratio	30 dB
Minimum launch power in OMA minus transmission and dispersion penalty (TDP)	-6.2 dBm
Minimum optical modulation amplitude	-5.2 dBm
Maximum average launch power of OFF transmitter[c]	-30 dBm
Minimum extinction ratio	3.5 dB

Copyright © 2008, Nortel Networks

Parameter	Specifications
$RIN_{12}OMA$ (maximum)	-128 dB/Hz
Maximum optical return loss tolerance	-12 dB
Maximum transmitter reflectance	-12 dB
Receiver characteristics	
Line rate (nominal)	10GBASE-LR 10.3125 Gbit/s ± 100 ppm 10GBASE-LW 9.95328 Gbit/s ± 100 ppm
Average receive power for BER 10^{-12}	-14.4 dBm to 0.5 dBm
Maximum average receive power for damage	1.5 dBm
Maximum receiver sensitivity in OMA	-12.6 dBm
Maximum receiver reflectance	-12 dB
Stressed receiver sensitivity in OMA	-10.3 dBm
Receiver electrical 3 dB upper cutoff frequency	12.3 GHz

Examples of an OFF transmitter are: no power supplied to the PDM, laser shutdown for safety conditions, activation of a PMD_global_transmit_disable or other optional transmitter shut down condition

10GBASE-ER/EW XFP specifications

The following table lists the transmitter specifications for the 10GBASE-ER/EW XFP. The reach for this XFP is up to 40 km at a wavelength of 1550 nm. The part number of this XFP is AA1403003-E5.

For more information about the 10GBASE-EX XFP, including test and measurement information and more specifications, see the IEEE 802.3ae standard.

ATTENTION

You can configure the XFP to operate in either LAN (Ethernet) or WAN (SONET) mode, depending on the module (8683XLR is a LAN-only module, and 8683XZR is a LAN/ WAN module). Model numbers ending in *R* denote a LAN interface; model numbers ending in *W* denote a WAN interface.

Table 34
IEEE 802.3ae 10GBASE-ER/EW XFP specifications

Parameter	Specifications
Line rate (nominal)	10GBASE-ER 10.3125 Gbit/s ±100 ppm 10GBASE-EW 9.95328 Gbit/s ±20 ppm
MTBF	675 000 hours
Center wavelength range	1530 to 1565 nm; nominal 1550 nm

Copyright © 2008, Nortel Networks

Parameter	Specifications
Distance	Up to 40 km
Link optical power budget	15 dB
Transmitter and dispersion power penalty	3.0 dB at 40 km
Transmitter characteristics	
Launch power	-4.7 to 4.0 dBm
Minimum side mode suppression ratio	30 dB
Minimum launch power in OMA minus transmission and dispersion penalty (TDP)	-2.1 dBm
Minimum optical modulation amplitude	-1.7 dBm
Maximum average launch power of OFF transmitter	-30 dBm
Minimum extinction ratio	3.0 dB
Maximum $RIN_{12}OMA$	-128 dB/Hz
Maximum optical return loss tolerance	-21 dB
Receiver characteristics	
Average receive power for BER 10^{-12}	-15.8 dBm to -1.0 dBm
Maximum receive power for damage	4.0 dBm
Maximum receiver sensitivity in OMA	-14.1 dBm
Maximum receiver reflectance	-26 dB
Stressed receiver sensitivity in OMA	-11.3 dBm
Receive electrical 3 dB upper cutoff frequency (maximum)	12.3 GHz

Examples of an OFF transmitter are: no power supplied to the PDM, laser shutdown for safety conditions, activation of a PMD_global_transmit_disable or other optional transmitter shut down conditions.

10GBASE-ZR/ZW XFP specifications

The following table lists the transmit specifications for the 10GBASE-ZR/ZW XFP. The reach is up to 80 km at a wavelength of 1550 nm. The part number of this XFP is AA1403006-E5.

For more information about the 10GBASE-ZX XFP, including test and measurement information and more specifications, see the IEEE 802.3ae standard.

Copyright © 2008, Nortel Networks

ATTENTION

You can configure the XFP to operate in either LAN (Ethernet) or WAN (SONET) mode, depending on the module (8683XLR is a LAN-only module, and 8683XZR is a LAN/ WAN module). Model numbers ending in *R* denote a LAN interface; model numbers ending in *W* denote a WAN interface.

CAUTION
Risk of equipment damage

To prevent damage to the optical receiver, ensure that at least 11 dB of attenuation is present between the transmit and receive ports.

Table 35
10GBASE-ZR/ZW XFP specifications

Parameter	Specifications
Line rate (nominal)	10GBASE-ZR 10.3125 Gbit/s ±100 ppm 10GBASE-ZW 9.95328 Gbit/s ±20 ppm
MTBF	675 000 hours
Distance	Up to 80 km
Link optical power budget	24 dB
Maximum transmitter and dispersion penalty	3.0 dB at 80 km (G.652 fiber)
Transmitter characteristics	
Center wavelength range	1530 to 1565 nm; nominal 1550 nm
Side mode suppression ratio (minimum)	30 dB
Average launch power	0 to 4.0 dBm
Optical modulation amplitude (minimum)	-1.7 dBm
Average launch power of OFF transmitter (maximum)	-30 dBm
Extinction ratio (ER)	minimum 3.5 dB end of life maximum 7.0 dB start of life
$RIN_{12}OMA$ (maximum)	-128 dB/Hz
Maximum optical return loss tolerance	-26 dB
Maximum transmitter reflectance	-12 dB
Receiver characteristics	
Wavelength range	1280 to 1575 nm. Sensitivity specified for 1530 to 1565 nm.
Signaling speed (nominal)	10GBASE-ZR 10.3125 Gbit/s ± 100 ppm 10GBASE-ZW 9.95328 Gbit/s ± 100 ppm

Copyright © 2008, Nortel Networks

Parameter	Specifications
Maximum average receiver sensitivity	-24 dBm
Maximum receive power (for BER 10^{-12} and 9 dB ER)	-7.0 dBm
Maximum average receive power for damage	5.0 dBm
Receiver reflectance (maximum)	-27 dB
Receive electrical 3 dB upper cutoff frequency	9.3 GHz

Copyright © 2008, Nortel Networks

Index

Symbols/Numerics

1000BASE-BX 24, 27, 51
1000BASE-EX 24, 27, 61
1000BASE-EX DDI 52
1000BASE-LX 24, 25, 26, 32, 44
1000BASE-LX DDI 47
1000BASE-LX GBIC specifications 58
1000BASE-SX 24, 25, 26, 32, 43, 44
1000BASE-SX DDI 46
1000BASE-SX GBIC specifications 57
1000BASE-T 24, 26, 32, 43
1000BASE-T GBIC specifications 56
1000BASE-XD 24, 26, 26, 32
1000BASE-XD DDI 48, 48
1000BASE-XD GBIC specifications 60
1000BASE-ZX 24, 26, 32
1000BASE-ZX DDI 49
1000BASE-ZX GBIC specifications 60
10GBASE-ER/EW 36
10GBASE-ER/EW XFP specifications 69
10GBASE-LR/LW 36
10GBASE-LR/LW XFP specifications 68
10GBASE-SR 36
10GBASE-SR XFP specifications 66
10GBASE-ZR/ZW 36
10GBASE-ZR/ZW XFP specifications 70

A

AA1403001-E5 36, 68
AA1403003-E5 36, 69
AA1403005-E5 36, 66
AA1403006-E5 36, 70
AA1419001-E5 32, 57
AA1419002-E5 32, 58
AA1419003-E5 32, 60
AA1419004-E5 32, 60
AA1419013-E5 25, 43
AA1419014-E5 25, 44
AA1419015-E5 25, 44
AA1419017-E5 32, 61
AA1419024-E5 32, 61
AA1419025-E5 25, 45
AA1419032-E5 25, 45
AA1419033-E5 25, 46,
AA1419040-E5 25, 46,
AA1419041-E5 32, 56
AA1419043-E6 26, 43
AA1419048-E6 26, 46
AA1419049-E6 26, 47
AA1419050-E6 26, 48
AA1419051-E6 26, 48
AA1419052-E6 26, 49
AA1419053-E6 26, 50
AA1419060-E6 26, 50
AA1419061-E6 27, 50,
AA1419068-E6 27, 50,
AA1419069-E6 27, 51
AA1419070-E6 27, 51
AA1419071-E6 27, 52
acronyms 9

C

cleaning, handling fiber optic connectors 14
  duplex connectors 15
  receptacle or duplex devices 17
connectors, cleaning 14
CWDM DDI SFPs 50, 50

Copyright © 2008, Nortel Networks

CWDM GBIC specifications 61
CWDM SFPs 45, 46

D

differential mode delay 57, 59
duplex connectors, cleaning 15
duplex devices, cleaning 17

E

electrostatic discharge 11

F

fiber optic cable
  cleaning connectors for 13
  precautions with 12

G

GBIC
  1000BASE-SX 57
  1000BASE-XD 60
GBIC physical specifications 56

M

multimode fiber
  in long distance applications 57, 59

O

optical attenuators,
  when to use 61

P

patch cords,
  for multimode fiber applications 57, 59

R

receptacle devices, cleaning 17

S

safety 11
SFP physical specifications 42

T

troubleshooting 34

X

XFP specifications 66

Copyright © 2008, Nortel Networks

Nortel Metro Ethernet Routing Switch 8600

Installation — SFP, XFP, and GBIC Hardware Components

Copyright © 2008, Nortel Networks
All Rights Reserved.

Publication: NN46220-301
Document status: Standard
Document version: 02.04
Document date: 14 February 2008

Sourced in Canada and the United States of America

To provide feedback or report a problem in this document, go to www.nortel.com/documentfeedback.

LEGAL NOTICE
While the information in this document is believed to be accurate and reliable, except as otherwise expressly agreed to in writing NORTEL PROVIDES THIS DOCUMENT "AS IS" WITHOUT WARRANTY OR CONDITION OF ANY KIND, EITHER EXPRESS OR IMPLIED. The information and/or products described in this document are subject to change without notice.

Nortel, the Nortel logo, and the Globemark are trademarks of Nortel Networks.
Cletop is a trademark of NTT-ME Corporation.
IEEE is a trademark of the Institute of Electrical and Electronics Engineers, Inc.
Kimwipes are a trademark of Kimberly Clark.
Lucent is a trademark of Lucent Technologies, Inc.
All other trademarks are the property of their respective owners.